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ABSTRACT

The paper reviews theory and research in the area of creative thinking and behavior. Theoretical interpretations or explanations of creative thinking are classified into five categories: definitional (introspective opinions on the nature of creativity), dispositional (Personality-based), psychoanalytic, behavioristic (traditional S-R psychology), and operational (specifying conditions for increasing creative behavior) approaches. The theoretical contributions of each approach are analyzed. It is concluded that existing explanatory constructs have relied upon larger, established systems (S-R behaviorism or Freudian psychology), and that no fully matured theoretical statement has been developed and directed specifically toward creativity. (Author/KW)

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THEORETICAL PAPER NO. 24

CREATIVITY: A REVIEW OF THEORY AND RESEARCH

REPORT FROM THE TASK AND TRAINING VARIABLES IN HUMAN PROBLEM SOLVING AND CREATIVE THINKING PROJECT

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CREATIVITY: A REVIEW OF THEORY AND RESEARCH

By William E. Roweton

Report from the Task and Training Variables in
Human Problem Solving and Creative Thinking Project

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Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

March 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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This Theoretical Paper is from the Task and Training Variables in Human Problem Solving and Creative Thinking Project in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowledge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, this project is focused on investigating creative problem solving as a trainable cognitive skill. The development and testing of creative thinking programs follows research on basic problem-solving variables in different situations.

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ABSTRACT

Creative behavior is a rapidly expanding interest area. In the present review, various theoretical interpretations or "explanations" of creative thinking are classified into five major categories: (1) definitional approaches, primarily introspective opinions regarding the nature of creativity; (2) dispositional or personality-based theories, focusing largely on the traits of creative individuals; (3) psychoanalytic viewpoints, consisting mainly of Freudian, neo-Freudian, and humanistic approaches; (4) behavioristic theories, drawing from traditional S-R psychology; and (5) operational approaches, which primarily are concerned with specifying conditions for increasing creative behavior. It was concluded that no fully matured theoretical statement has been developed and directed specifically toward creativity. Existing explanations have relied upon larger, established systems such as S-R or Freudian psychology. A meaningful and experimentally testable theory of creativity is yet to be proposed.

I
INTRODUCTION

The scientific study of creativity is slowly coming of age. In the last 10 years, interest has been increasing in the experimental study of creativity in educational psychology, in industry, and in education. Guilford (1967) noted that psychology until 1950 had been generally unconcerned with the complex phenomena of creativity, although there were rare exceptions (e.g., Cleeton, 1926; Hansbrook, 1931; Harms, 1939; Hartman, 1931; Hutchinson, 1931; Jastrow, 1898; Simpson, 1922). Industry, however, motivated more by profit than intellectual curiosity, had been concerned with idea production in the late 1930's, e.g., Osborn began his famous brainstorming in 1938 and General Electric's creativity course was initiated in 1937. Nonetheless, Guilford's (1950) epoch-making paper definitely introduced the study of creativity to the rigors of experimental psychology. The founding of the Creative Education Foundation in 1957, the relatively recent introduction of the Journal of Creative Behavior in 1967, and recently produced programs designed to enhance creativity in educational settings (e.g., Davis & Houtman, 1968) have further indicated a remarkable increase of interest.

The literature surveyed in numerous reviews (Davis, Manske & Train, 1967; Golann, 1963; Hahn, 1968; Mooney, 1957; Taylor, 1964) has indicated that creativity has been studied traditionally as a cognitive process or as a product which reflected the underlying creative process.

In the present taxonomy, three approaches are relevant to a "process" orientation to creativity: definitional, dispositional, and psychoanalytic. The definitional approach is the least rigorous of all; it essentially consists of a list of opinions based largely upon each author's introspective reflection of what creativity might be. The dispositional (personality) approach employs questionnaires and personality inventories (e.g., Gough's Adjective Checklist), interviews, "living-in" assessments, and other dispositional indicators such as intelligence and cognitive style measures. The psychoanalytic approach, the third major process-orientation, consists almost solely of contributions from clinical (e.g., neo-Freudian) psychology; however, humanistic (e.g., Maslow and Rogers) psychology also maintains a process-orientation to creativity. Creativity is treated as very complex human behavior sometimes shrouded in a mystical aura of inexplicability. Creativity, according to all three viewpoints, is natural human behavior for which all humans have some capacity.

A "product" orientation to creativity includes both the S-R behavioristic and the operational approaches. The S-R behavioristic approach, really the only inroad of experimental psychology, is comprised of the contributions of only a few researchers (e.g., Maltzman, 1960; Mednick, 1962; Staats, 1968). The most common research procedure has been some form of verbal association, as an independent training variable (Maltzman, 1960) or as a dependent measure (Mednick, 1962). Either way, the influence of a traditional response-hierarchy definition of problem solving is always apparent.

The operational approach, on the other hand, places special emphasis upon training creativity. Creativity is defined by operations within training programs (e.g., Davis & Houtman, 1968) and learnable techniques (e.g., the checklist procedure) which have been shown to enhance creative output (cf., Parnes & Harding, 1959).

II

APPROACHES TO CREATIVITY

The theoretical contributions of the definitional, behavioristic, dispositional, psychoanalytic, and operational interpretations will be further elaborated in the following sections. It will be evident that no fully matured theoretical statement has been developed and directed specifically to creativity. Existing explanatory constructs have relied upon larger, established systems such as S-R behaviorism and Freudian psychology. Experimental psychology is long overdue for a direct and detailed theory of creativity.

DEFINITIONS OF CREATIVITY

Definitions, as explanatory constructs in creativity, have had an extended history. These definitions are conceptualizations of "what creativity is," but seldom lend themselves to an empirical test; the greatest value of definitions as explanatory constructs is heuristic. Therefore, for experimental psychologists, definitions, like Freudian psychology, can provide a potentially rich source of testable hypotheses.

Definitions of creativity are quite varied:

1. Sensitivity: "Creativity is the encounter of the intensely conscious human being with his world" (Rollo May).

2. Originality: "Creative ability appears simply to be a special class of psychological activity characterized by novelty" (Newell, Shaw, & Simon).

3. Practicality: "Creativity is the disposition to make and to recognize valuable innovations" (H. D. Lasswell).

4. Originality and Practicality: "Creativity is the occurrence of a composition which is both new and valuable" (Henry A. Murray).

5. Product: "It would seem, then, that there is no unique entity identifiable as the creative process. All we can identify is the product. And it is from the product that we infer the existence of a process" (H. Herbert Fox).

6. Product and Process: "The product and the process are both important. Without the process there would be no product. Without the product . . . there might might not be more than fantasy . . ." (Eugene A. Brunelle).

7. Morphological Synthesis: "Creativity is the production of meaning by synthesis" (Myron S. Allen).

8. Combinations: "Creativity is a marvellous capacity to grasp two mutually distinct realities without going beyond the field of our experience and to draw a spark from their juxtaposition" (Preface to Max Ernst Exhibition, 1920).

The dozens of other relevant definitions (e.g., see Kaiser Aluminum News, 1968) can be placed into at least one of these eight categories. The large number of definitions attests to the interest in creativity by individuals of many diverse vocations and, in addition indicates the scope of human behavior involving creativity.

BEHAVIORISM

According to some S-R formulations, if the production of original and/or creative ideas is practiced and reinforced, the emission of such low dominance ideas is likely to increase (Maltzman, Bogartz, & Breger, 1958). Maltzman demonstrated that when S free-associated to a list of stimulus words, responses became more original as S produced more and more responses to the same verbal stimuli (Maltzman, Bogartz, & Simon, 1959; Maltzman & Gallup, 1964; Maltzman, Simon, Raskin, & Licht, 1959). Originality in successive "free-association" sessions was facilitated by previous associative experience (Maltzman, 1960), an effect lasting for several days (Maltzman, Simon, & Licht, 1959). Also, performance on the Remote Associates Test (Freedman, 1965; Maltzman, Belloni, & Fishbein, 1964) and the Maier two-string problem (Maltzman, Brooks, Bogartz, & Summers, 1958) was facilitated by "relevant" associative pretraining, i.e., word association training suggesting solutions to a particular problem. Maltzman, Raskin, and Simon (1959) noted that practice in free-associating did not facilitate originality unless Ss were also required to provide a number of different responses for each stimulus word as opposed to giving single responses to a longer list of words for the same amount of time.

The results of some studies have not been consistant with Maltzman's findings (Britt, 1967; Gallup, 1963; Unger, Caron, & Parloff, 1963). Gallup, for instance, noted that Ss were just as creative on the second list of stimulus words in a free-association paradigm without repeated presentations of the first stimulus list.

Staats (1968) has dealt with creativity as an example of complex human behavior. Creativity occurs when two or more stimuli which normally do not elicit one another as mediating stimulus events become associated. The "creative" association is not serendipitous since it results from a series of "events" which has forced the stimuli into spatial and/or temporal contiguity. For instance, S could observe a teflon-coated pan in a sink, associate teflon with sink, and therefore come to suggest that sinks should be teflon-coated for easier cleaning. Staats' position is not limited to verbal creativity since stimulus contiguity may result from either verbal or nonverbal (e.g., perceptual) activities.

Earlier studies in traditional human problem solving have investigated topics related to creativity such as "functional fixedness" or inflexibility. For example, if in the Maier two-string problem (Maier, 1931) S thinks of using a screwdriver only in its most common way, it is very unlikely that he will immediately think of using the screwdriver's weight as a pendulum (Adamson, 1952; Birch & Rabinowitz, 1951). Also, a "mental set" to use a similar procedure to solve the same and similar problems can interfere with S's performance on the Luchins' (Luchins, 1942) water-jar problem as new, more efficient logical operations present themselves. Performance can be improved by rest periods (Adamson & Taylor, 1954) or by presenting the problem to S in a logically and perceptually coherent manner (Maier, 1930).

Mednick's (1962) Remote Associates Test (RAT) assumes an associative (i.e., behavioristic) definition of creativity. A S is presented three words (e.g., Christmas, birthday, and line) and is asked to supply a fourth, related term (i.e., party). Certain investigators (Higgins, 1966; Houston, 1963; M. T. Mednick, S. A. Mednick, & E. V. Mednick, 1964; S. A. Mednick, 1962) have concluded that performance on this task is related to both creative behavior and intelligence (Mednick & Andrews, 1967). On the contrary, Andrews (1965) has suggested that performance is dependent on S's communicational abilities, strength of motivation, etc., and in fact is independent of creative ability.

The behavioristic approach to creativity has notable assets and liabilities. Concerning contributions, certain methodology (free-association training, RAT) has permitted rigorous and scientific investigations of originality in verbal tasks. In addition, the use of older, well-established S-R paradigms and concepts has demonstrated commonalities between one form of originality and other examples of experimentally studied human behavior. Nevertheless, the behavioristic approach is limited in generality primarily to highly verbal adults. Also, the responses thus far investigated have mostly been a "spewing" of words with little attention to the production of ideas of practical consequence.

Many experimental psychologists may believe that all definitive studies of creativity have been performed well within the behavioristic tradition. True, some studies have approached the training of originality (Maltzman, 1960) and creativity (Mednick, 1962; Staats, 1968) employing S-R mechanisms as explanatory constructs. However, since experimental psychology's view of creativity has been somewhat confining, the scientific study of creativity is certainly not limited to S-R experimentalists.

PSYCHOANALYTIC

Traditional

One of the earliest theoretical approaches to creativity is found in Freudian psychology. Freud (see Brill, 1938) studied creative individuals in the literary and visual arts. For Freud, creativity and, for that matter, all cultural achievements result from the diversion or sublimation of libidinal energy from sexual activities to asexual goals, because efforts to satisfy the sexual drive are repeatedly frustrated. Sublimated libidinal energy also may result in extreme intellectualization and/or other defensive reactions. Sublimation essentially permits S to invest energy in socially approved scientific, artistic, and ideological activities. Creativity is a particularly appropriate sublimation since it represents escape into a "fantasy life" not involving frustration or anxiety.

Anxiety, a key issue in psychoanalytic thought, has been related to creativity by Fleischer (1965), Hadley (1965), and Nydes (1962). In typical Freudian language Nydes (1962) noted that creativity represents an overcoming of anxiety; that is, reality enters deep into the psyche without causing fear or panic. Hadley (1965) administered the Minnesota Tests of Creativity, the Barron Anagrams Tests, the Sarason Test Anxiety Scale for Children, and the Sarason General Anxiety Scale for Children to 215 Seventh- and Eighth-Grade Ss. More creative Ss exhibited less test anxiety.

Certain standard clinical techniques have also been used to investigate creativity. Bowers (1965) found that post-hypnotic suggestions increased creativity on the Remote Consequences Test. In addition, Pogue (1964) used the Rorschach and the TAT projective tests to find that creativity is related to IQ, self-esteem, and socio-economic status (SES). Projective techniques have also been used to establish relationships between creativity and "integrated and productive" responses in research chemists (Stein & Meer, 1954), intellectual competence, breadth of interests, independence of mind, self-assertiveness (Schmiek, 1954), and reduced repression and considerable affect and primary-process thinking directed at external objects (Myden, 1957).

Subsequently, Myden (1959) compared the Rorschach protocols of 20 artists and a matched group of 20 non-artists. The artists were of superior intelligence, exhibited much of their potential, were outer-oriented, nonconforming, "healthy," and had a rich "inner life." Importantly, artists exhibited significantly less id repression than non-artists, supporting Freud's notion that creative individuals' psychic energy (primary process thinking) is more readily accessible.

Of course, psychoanalytic explanations of creativity have not received complete confirmation even by neo-Freudians. For instance, Racusen (1952) studied 50 normal, 20 schizophrenic, and 20 neurotic Ss and reported that performances on creative and projective tests were not appreciably related.

Neopsychoanalysis

Many theorists have divorced themselves from traditional Freudianism either because of inconsistancies in the "old" school or because the traditional theory did not adequately handle certain behaviors.

Kris (1952) conceptualized creativity as the relaxation of the boundaries of ego forces which usually keep the id in check. Creative inspiration then, is characterized as a flexibility and/or lessening repression stemming from a released personality system. The concept of sublimation is extended into a two-part process: (1) directing energy toward acceptable goals and then (2) elaborating, a dedication to solution-oriented work. Creativity is thus more than an unconscious diversion of libidinal energy; it also involves a conscious awareness of the problem and a desire to obtain a solution.

Jung (1953), another neo-Freudian, studied artistic creativity. To Jung, creativity has two modes of expression—psychological and visionary. The psychological mode, which considers S to be actively involved in the creative process, was totally dependent upon human consciousness. The visionary mode, of particular importance to Jung, involved the reproduction of "primordial experiences" or "archetypes" from the "collective unconscious." Jung believed that the human unconscious from one generation to the next stored the memory of "critical" events, and visionary creativity was S's passive acceptance of an unconscious animation of these previous evolutionary events.

Humanistic Orientation

Humanistic psychologists consider creativity a product of a "healthy" self, a symbol of man's growth-potential. Creativity is not the pessimistic avoidance of anxiety through fantasy but a direct confrontation involving a deliberate change in the relationship between self and the environment.

Rogers (1962) studied creative behavior within the context of interpersonal relations. Creative expression is a natural tendency in a milieu exhibiting psychological safety (accepting S as worthy, no external evaluation, empathetic understanding) and psychological freedom (free symbolic expression and not simply indulgence). The creative individual has an openness to experience, an internal locus of evaluation, and an ability to "toy" with elements. Rogers considers creativity to be qualitatively the same process whether exhibited by a housewife or research physicist.

Perhaps the most well-known humanistic psychologist is Maslow (1958; see also Gowan, Demos, & Torrance, 1967), who stresses personality instead of achievements and products in his version of "self-actualizing" creativity. Some characteristics of a self-actualizing personality are boldness, courage, freedom, spontaneity, perspicuity, integration, and self-acceptance. Creative individuals are thus seen as psychologically healthy, capable of voluntary "regression" (suggesting creativity is a child-like quality), not "compulsive-obsessive," and not fearful of novelty. Maslow also indicated that some creative expression may be dependent on both a self-actualizing personality and years of specialized training, i.e., special-talent creativity.

Summary

The psychoanalytic and neopsychoanalytic approaches seem to treat creativity as a mystical human ability which is somehow dependent upon personality development. Within such frameworks, emphasizing unconscious forces and complex personality variables (e.g., ego forces), creativity would have little appeal for experimentally oriented researchers. Nevertheless, psychoanalytic constructs have had an extended history and should be considered a viable approach.

Humanistic and existential psychologies exhibit certain important biases not present in laboratory-oriented psychology. Maslow (1968), for instance, indicated a full appreciation of man as a complex human problem solver and concern for an environment conducive for man's optimal (i.e., creative) functioning.

DISPOSITIONAL

It would seem intuitively evident that creative expression most basically depends upon S's personality and those variables crucial to personality development. Therefore, in some respects, the dispositional approach, consistent with the older psychoanalytic approach, examines the most basic behavioral structures (i.e., personality dimensions) of creative expression. Unlike psychoanalysis, the dispositional approach employs methodological techniques similar to those used by experimental psychology.

Personality

Kagan (1965) studied the effects of certain personality variables and "testing" environments upon creativity. He noted that S's attention to novelty, attitudes of acceptance, motives for differentiation, expectancy of success or failure, and level of anxiety during testing were important determinants of creative expression. If creative problems were presented in a "test-like" environment, anxiety resulted which, in turn, debilitated creative problem-solving. Dentler and Mackler (1964) also demonstrated that anxious Ss were less original.

Meyer (1953) related creative production to ethnocentrism. When Ss were divided into high and low ethnocentric groups, the number of ideas produced by both groups was about the same, but the ideas produced by the low ethnocentric Ss were more original.

In order to relate creativity and still other personality variables, Gough (1957) required Ss to analyze perceptual fields and make esthetic judgments. Along with the results of other tests, Gough concluded that the creative individual was intellectually competent, habitually curious, cognitively flexible, esthetically sensitive, and dignified. Also, creative Ss conformed less readily to group opinion.

Some studies have assumed that members of certain vocational groups exhibit more natural creativity than other groups. Implicit in this assumption is a belief that different personality types typically choose different vocations, that is, work not in conflict with their personality. Some apparently related studies sought to identify personality or other traits distinguishing degrees of creative expression within a given occupation.

First, Drevdahl (1961) studied professional creativity in psychologists. Drevdahl divided psychologists into three groups: creative, noncreative and productive, and noncreative and nonproductive. Drevdahl found that professional educational training was a primary influence upon creative potential. Family and emotional factors were also of some importance,

but socio-economic status (SES) did not appear to be a crucial variable.

Second, some studies (Fisichelli & Welch, 1947; Guilford, 1957; Hirsch, 1958; Lowenfeld & Brittel, 1959; Welch, 1946) have investigated creativity in artists. Fisichelli and Welch compared professional artists, art students, and non-artists on several tasks, e.g., constructing furniture from wooden blocks. Both the professional and amateur artists were more creative than non-artists.

Getzels and Csikszentimihalyi (1964) reported that art students expressed more interest in "aesthetic" values than "economic" and "social" values. Also, art students preferred more complex visual forms in a self-expressive creativity task, the Creativity Design Test.

Third, Bloom (1955) and others (e.g., Marzill, 1957; Walker, 1952; Whelan, 1959) studied creativity in chemists and mathematicians. Although the results of the studies differed somewhat, creative chemists/mathematicians generally were complex personalities who enjoyed reading and were independent thinkers, etc. (See also Buhl, 1958, and Van Zelst & Kerr, 1951, 1952.)

Fourth, creative physical scientists (see Harris, 1955; Mandell, 1950; Sprecher, 1957) were more often men (Roe, 1951, 1953b), Protestant (Knapp & Goodrich, 1952; Roe, 1953b), socially distant (McCelland, 1967; Cattell & Drevdahl, 1955; Stein, 1953), and hardworking (Roe, 1951, 1953a, 1953b). Also, creative physical scientists were disturbed by "complex" human emotions (Knapp, 1956; Roe, 1951; Teevan, 1954) and enjoyed music but not poetry and art. They were strongly masculine (Terman, 1954), interested in analysis and details (Terman, 1954), and were usually first born (Roe, 1951).

Incidentally, when comparing creativity in certain occupational groups (e.g., artists vs. non-artists), the results may be difficult to interpret because of certain confounding factors. For example, studies indicating that artists prefer complex forms more often than non-artists do not seem surprising since an interest in colors, complex figures, etc., likely accounted for a student's initial interest in art. Also, when given self-expressive creative art tests (e.g., elaborating upon plain circles), artists, of course, would be judged more original and creative; artistic (technical) skill is invariably confounded with overall artistic expression.

The University of California's Institute for Personality Assessment and Research (IPAR) has studied the involvement of personality factors in creative expression (e.g., Barron, 1969). The IPAR conceptualizes creativity (i.e., the production of original ideas) as a complex of accessible personality traits normally distributed throughout the population. IPAR has assembled personality inventories (e.g., Gough Adjective Checklist), projective tests (e.g., Thematic Apperception Test: Originality Rating), aesthetic preference measures (e.g., Barron-Welsch Art Scale; Turney Designs), and others (e.g., Unusual Uses), all of which were used to detect recurrent personality characteristics of creative individuals. Unlike the stereotype, creative individuals were found to be mentally "healthy" and did not exhibit, as a rule, excessively odd social behaviors. Barron (1962) reported that creative individuals were more observant of others and their behaviors, valued truthful and explicit reporting, exhibited more energetic behavior, demonstrated flexibility in the perception of themselves and others, were surrounded in their environment by complexity, fantasy, and imaginative thoughts, exhibited high sensitivity to synthesis and exacting discrimination, were aware of their own and others' feelings, questioned the implicit, preferred the complex and asymmetrical and, in general, were psychodynamically more complex.

In sum, many studies relating personality and creativity are solely dependent upon Ss' verbal reports (i.e., personality inventories, adjective checklists). Data from verbal self-reporting, like introspection of an earlier age in psychology, lacks empirical validity in the sense of not being publicly observable, repeatable, and falsifiable. Other studies utilizing the dispositional approach, and especially those operationally facilitating creative idea production (discussed in a subsequent section), use response measures more consistent with experimental psychology.

For other discussions relating personality, vocation, and creativity, see Garwood (1964), Graves, Ingersoll, and Evans (1967), Hyman (1961), and MacKinnon (1961, 1962, 1965, 1967). Additional studies have also related creativity to child-rearing patterns (Sears, 1967), to general preferences for incongruity (Hake, 1967), to delinquency (Kuo, 1967), to bilingualism (Jacobs, 1966), and to other personality variables (Green, 1957; Hitt & Stock, 1965; Rees & Goldman, 1961; Rutherford, 1960).

Intelligence and Creativity

An association between creativity and intelligence (considered here an integral component of personality) has been reported in some studies (e.g., Meir & Stein, 1955;

Wade, 1968) but not confirmed in others (e.g., Taylor, 1959).

Guilford (1950, 1962) introduced experimental psychology to the scientific study of creativity through his classic structure of intellect model. "Creativity" is called divergent thinking in the structure of intellect model, which implies a resistance to converging upon a single solution in favor of producing many solutions. Using factor analytic procedures, components of particular importance to divergent thinking were identified in Guilford's creativity tests (e.g., Unusual Uses problem) as (a) sensitivity to problems, (b) word fluency, (c) ideational fluency, (d) associational fluency, (e) expressional fluency, (f) spontaneous flexibility, (g) adaptive flexibility, and (h) originality. Wilson, Guilford, and Christensen (1953, 1954) administered a battery of creativity, intelligence, and other tests to 410 air cadets. Their analyses indicated that verbal comprehension, numerical facility, and general reasoning factors also were involved in creative performance.

Thurstone (1952), another factor analyst interested both in creativity and intelligence, reported that profiles of Ss' "primary abilities" can be used to predict creative potential. Primary intellectual abilities of some importance were (a) space factors (e.g., body orientation), (b) perceptual speed (e.g., seeing details quickly), (c) closure factors (e.g., fusing an incomplete perceptual field), and (d) memory.

Savoca (1965) investigated the effects of reinforcement, race, IQ, and socio-economic status (SES) upon divergent thinking. Cultural deprivation was negatively correlated to divergent thinking (i.e., Ss who were Negro, of low intelligence, and of the lowest SES group exhibited the least creative potential). Two independent research teams have investigated the relationships between intelligence and creativity. First, Getzels, Jackson, and others (Getzels & Jackson, 1958, 1961a, 1961b, 1962; Getzels, Jackson, & Burt, 1962) compared two groups of children ranging from high school to elementary school age—highly intelligent Ss without concomitant high creativity and highly creative Ss without concomitant high IQs. Getzels and Jackson (1961b, 1962) noted that both groups were of similar scholastic achievement but were different on value orientations, effects on teachers, fantasy productions, career aspirations, and home environments. Highly intelligent Ss more readily conformed to classroom behavioral standards and were therefore preferred by teachers (Getzels & Jackson, 1958). Highly creative students were judged more disruptive in the classroom, were permitted more independence at home, and reported more imaginative fantasies. Note, however, that the Getzels and Jackson findings may not be generalizable since all of the Ss studied were students at the University of Chicago Laboratory School and therefore represent a restricted range of (high) intelligence.

Getzels and Jackson studied only the low intelligence-high creativity and high intelligence-low creativity groups. Wallach and Kogan (1965a, 1965b, 1967) subsequently sampled a more representative student population, 151 Fifth-Grade Ss from four populations: Ss of high intelligence-high creativity; high intelligence-low creativity; low intelligence-high creativity; and low intelligence-low creativity. Unlike the Getzels-Jackson results, creative test performance and intelligence were not highly related, but the ten creativity measures were highly intercorrelated. While Getzels and Jackson reported that their five measures of creativity intercorrelated (low) as well with each other as these measures did with intelligence, the Wallach and Kogan study definitely indicated that creativity is a separate dimension.

Wallach and Kogan further noted that each of its groups exhibited distinctive behaviors. High intelligence-high creativity Ss typically displayed desirable academic and extracurricular school behavior while high intelligence-low creativity students were compulsive academic achievers. Low intelligence-high creativity and low intelligence-low creativity Ss, less liked by teachers, emitted attention-getting classroom behavior more often than Ss in the high intelligence groups. In addition, Ss in the low intelligence-low creativity group exhibited better social relations than low intelligence-high creativity Ss.

The results of studies relating creativity and intelligence and/or academic performance have been quite inconclusive since the findings of one study often contradicted the findings of another. Evaluating creativity-IQ studies, Ripple and May (1962) astutely reported that any statistical relationship between creativity and IQ depended upon the range of intelligence scores sampled. Scores obtained from heterogeneous IQ samples are more predictive of creative behavior than intelligence measures from relatively homogeneous samples merely because increasing population variance increases correlations (i.e., restricted range problem). Also, the results of each study needed to be qualified, since they depended upon the population tested and the measures of creativity and intelligence employed (see Thorndike, 1963a, 1963b).

Numerous other discussions and studies relating intelligence and creativity are available (e.g., Cropley, 1966; Guilford, 1966; McNemar, 1964; Moore, 1966; True, 1957; Vernon, 1964).

Cognitive Style and Creativity

"Cognitive style" is not a good descriptive term because it elicits more confusion than clarity (Coop, 1969). A measure of cognitive style in human problem-solving research could refer to general attitudes (Getzels & Jackson, 1961a), openness to experience (Schulman, 1966), performance on certain perceptual tasks (e.g., Spotts & Mackler, 1967), general problem-solving strategies (Bruner, Goodnow, & Austin, 1956), and so forth.

Getzels and Jackson (1961a) compared some child-rearing variables of highly intelligent and highly creative Ss. Parents of highly intelligent children were very watchful and critical of their offsprings' behavior. The parents of highly creative Ss focused on less "visible" qualities, e.g., abstract ideals. Therefore, the latter group might be considered more "open" to experience.

Schulman (1966) related the performance of 89 Fourth Graders on a creativity task (Drawing Completion Test, DCT) and two perceptual tests (Changing Figures Test; Finding of Enclosed Areas Test, FEAT). The correlation between performance on the DCT and the FEAT was low but significant, $r = .18$; $p < .01$. Ss scoring high on the DCT also scored high on the FEAT, but not the reverse. The results suggested that perceptual behavior may predict creative behavior in some cases. Conceivably, creativity and perceptual behavior may be related to another and more basic personality dimension.

Mackler (1964; see also Mackler & Shontz, 1964, 1965) developed a Life Style Scale to measure visual and kinesthetic behaviors in five groups: art majors, dance majors, physically disabled, visually but not physically disabled, and a control group. As might be expected, art majors were most visually oriented, while dance majors scored high kinesthetically. Performance on the Circles Test, a creativity test requiring Ss to elaborate on plain circles, discriminated art majors as a group from the remaining Ss. Physically disabled Ss performed worst of all on the total battery of measures.

Spotts and Mackler (1967) related two measures of "field dependence-independence" to creative test performance. They administered to 138 college males the Embedded Figures Test (EFT, short form), the Hidden Figures Test (HFT), two verbal (Ask and Guess; Unusual Uses) and two non-verbal (Circles Test; Decorations) creativity tests and also obtained two intelligence measures. Cognitive style scores were used to divide Ss into high, medium, and low field dependence-independence groups. The cognitive style groupings did not differ on IQ. The results indicated that field-independent Ss (as measured by the EFT) were significantly more creative, as assessed by a composite creativity score. Both cognitive style measures, EFT and HFT, were related to scores on the School and College Abilities Tests, if the verbal scores were excluded.

Creative individuals may be more highly sensitive to environmental cues. Mendelsohn and Griswald (1964) divided 108 college students into groups of high, medium, and low Remote Associates Test (RAT) scores. The Ss were instructed to memorize 25 words ("focal" stimuli) while 25 other words ("peripheral" stimuli) were presented auditorially. After ten minutes, Ss were asked to solve 30 double-solution anagrams. Ten each of the previously presented "focal" and "peripheral" words were anagram solutions; ten of the anagram words were new ("neutral"). Finally, students were asked to list all words which they could recall from the previous memory task. The results indicated that the three groups did not differ significantly in the number of neutral anagrams solved, while all groups solved more "focal" anagrams than "neutral" ones. Highly creative Ss solved significantly more anagrams; that is, creative Ss utilized both "focal" and "peripheral" cues while solving anagrams more so than did Ss in the other groups. The groups did not differ on the recall task. Mendelsohn et al., suggested that the results are attributable to the superior reception and/or processing of previously presented stimuli by highly creative Ss.

Generally, the usefulness of many of the above creativity studies seems quite restricted and questionable, particularly since the reliability and validity of the instruments employed were rarely established. Certainly, the results and conclusions are no more generalizable than the reliability and validity of the tests will permit. The most scientific approach to studying creativity employs testing instruments and experimental procedures, some of which are exemplified in the operational approach, yielding objective, reliable and valid response data.

OPERATIONALISM

The above approaches to creative behavior did not attempt to deliberately manipulate,

alter, or in some way enhance creative behavior. Viewpoints categorized under operationalism define "creativity" by the specific procedures used to train it. Many existing books (Osborn, 1963), programs (Edwards, 1967; see also McPherson, 1968), courses, and techniques have sought to systematically alter the creative problem solver's milieu and/or training so as to identify effective determinants of creative behavior.

The most popular operational approaches to creative thinking have been group problem solving courses. Even A. R. Stevenson's (see Samstad, 1962) early course in 1937 at General Electric demonstrated that methods of idea production can be taught and encouraged. A more recent but similar industrial course sponsored by AC Spark Plug Division of General Motors demonstrated that a 10-week training course can increase the number of ideas suggested both by "intuitively" productive and nonintuitively productive thinkers (Simberg & Shannon, 1959). Two effective group-think methods are brainstorming and Synectics.

Brainstorming

The most successful group problem-solving technique has been Osborn's (1948, 1963) brainstorming procedure. Although many (e.g., Mathews, 1956) doubt whether a basic personality trait can be altered in merely 8 or 10 hours of group problem solving, Osborn's (1963) techniques have received considerable support. According to Arnold (1959), typical brainstorming sessions disallow evaluation of ideas (i.e., judgment is deferred), encourage "wild" ideas, teach "hitchhiking" (i.e., building upon each other's ideas), and discourage the involvement of "specialists."

Osborn (1963) noted that the creative thinking process consists of three stages—fact finding (problem definition, preparation), idea finding (idea production, then development), and solution finding (evaluation, adoption). Osborn's creative thinking stages are merely restatements of Wallas' (1926) steps in human problem solving. Nevertheless, brainstorming has uniquely augmented Wallas' preparation, incubation, illumination, and verification with effective problem-solving principles, especially deferment of judgment.

Experimentally, brainstorming principles have met with some success. Arici (1965) instructed half of his Ss in brainstorming principles, while the remaining Ss were not aware of brainstorming procedures. Some Ss worked in groups, others worked individually. Those Ss employing the brainstorming procedures thought of more ideas and ideas of a higher quality than did the non-brainstormers. Idea quality was related to idea frequency. Cohen, Whitmyre, and Funk (1960) reported that the production of "unique" ideas was most facilitated when brainstorming principles were employed by pairs of adults. Hansen (1962) also successfully applied some of Osborn's brainstorming techniques in a Harvard Business School marketing class.

Parnes and his colleagues (Meadow, Parnes, & Reese, 1959; Parnes, 1963a, b; Parnes & Meadow, 1959, 1960) have consistently found that brainstorming instructions significantly facilitate idea production; that is, more ideas were produced with deferred judgment procedures than when ideas were criticized as developed. Brainstorming procedures were successful regardless of age, sex, or IQ levels tested (Parnes, 1962); also, the deferred judgment principle can be successfully applied in individual as well as group problem-solving sessions. Other studies (Meadow & Parnes, 1959; Parnes, 1961) indicated that creative ideas were more frequently produced later in the idea-producing sessions, suggesting that idea quantity and quality indeed were integrally interdependent (see also Manske & Davis, 1968).

Of course, numerous disconfirmations (e.g., Gerlach, Schutz, Baker & Mazier; 1964) have questioned the efficacy of brainstorming procedures. Arici (1965) in a study previously mentioned found that individuals produced more ideas than groups, regardless of whether or not the brainstorming procedures were introduced. The Dunnette, Campbell, and Jaastad (1963) study suggested that four-man brainstorming teams, compared to individuals, inhibited idea production, provided that Ss working individually had had group experience (see also Taylor, Berry, & Block, 1958).

Other studies have discussed brainstorming and its relation to personality variables (Lindgren & Lindgren, 1965a, 1965b) and instructions (Turner & Rains, 1965).

Synectics

William J. J. Gordon's (1956, 1961) group problem-solving method, Synectics, was designed for industry. As with Osborn, Gordon's method is a group problem-solving procedure. Gordon (see Alexander, 1965; Lincoln, 1962) assumed that everyone was latently creative and that affective human behavior was just as important as intellect in creative production. Synectics demands that idea producers become involved and detached simultaneously from

problems so that the "strange becomes familiar" (problem is simplified and clarified) and the "familiar becomes strange" (new viewpoints are sought). Since Gordon originally felt that swearing would break down internal censors so that creative potential could freely flow, sessions are noted for blatant earthiness. Like Osborn's brainstorming, synectic sessions defer judgment, encourage wild ideas, and use group members of heterogeneous backgrounds.

In the spirit of the traditional problem-solving steps, synectics (see Prince, 1968) also has defined its creative thinking stages. First, a general statement of the problem is given. Next, the many ramifications of the problem are discussed by the group. Members express their opinion(s) of what the problem concerns, and the group chooses to develop one opinion—the "Problem as Understood." Finally, this specific problem is examined and solutions sought.

Synectics stresses analogical thinking whereby Ss generate similes and metaphors, particularly those drawn from nature, to facilitate idea production. After posing a problem, the leader encourages participants to ask how animals, insects, or even plants have solved similar problems. Solutions for a parking problem, for example, may be found by considering how bees or ants "store things." Proposing ideal but apparently ridiculous problem solutions, such as having insects work on command to solve a transportation problem, is another synectic method for stimulating new viewpoints on a problem. "Playing with" or free-associating word meanings may lead to still more new ideas. For example, speculating on the meaning of the word "opening" (cutting, prying, unfolding, etc.) may suggest new designs for a can opener. Ideas stimulated by using the synectic methods may seem "silly" and inappropriate for solving serious problems. However, it is exactly the wild, far-fetched, perhaps "silly" ideas which are sought, since these often lead to the most creative and workable problem solutions. For instance, when faced with the problem of inventing a vapor-proof closure for space suits, one synectic group imagined insects running up and down the closure manipulating little latches —a far-fetched idea which led to a workable air-tight zipper. "Ideal" metaphorical solutions are then evaluated by specialists and technicians, an integral aspect of synectic problem solving.

OTHER PROGRAMS, PROCEDURES, AND COURSES

Morphological Synthesis

Myron Allen (1962, 1966), creator of morphological synthesis, presents a technique potentially capable of producing more ideas and idea combinations than any other available procedure. Ss first identify two or more important characteristics or dimensions (e.g., color, shape) of a problem and then list specific values (e.g., red, blue, green; square, round, triangular) for each. They then examine all possible combinations, utilizing one value of each characteristic. For example, if students are asked to "invent" a new line of pop-up toasters, all combinations of 15 shapes, 20 different colors and color patterns, and 5 sizes would instantly produce 1500 possible products. It is possible, however, that a rigid application of the morphological analysis procedure conceivably might prevent a thinker from approaching a problem from different, more imaginative perspectives (Davis, 1969). For example, students intent on examining the 1500 combinations of ideas for pop-up toasters may fail to detect entirely new means of toasting bread. The method is logically sound and is incorporated into many courses and programs (e.g., Davis & Houtman, 1968). The morphological synthesis technique invariably produces an enormous quantity of idea combinations in a very short time.

Attribute Listing

Crawford's (1948, 1954) attribute-listing technique utilizes S's abilities to observe, analyze, and relate aspects of the environment. The Ss itemize important attributes (or parts) of a product and then consider each attribute as a source of potential change or improvement. For example, with an object as simple as classroom chalk, S might learn to identify the attributes of size, shape, color, and material. Then, by considering changes for each of these individual attributes, ideas for a large variety of chalk may be quickly produced. Of course, the attribute-listing procedure is limited to problems whose important attributes are identifiable. Attribute listing both sensitizes students to various properties of objects and equips them with a simple yet very productive means of innovation. This technique, like other operational approaches, equates creativity with deliberate problem-solving procedures, i.e., creativity is not totally inspirational and accidental.

Checklist Procedure

Essentially, an idea checklist is a prepared list of possible sources of innovation in respect to a given problem. Davis and his colleagues (Davis, 1969; Davis & Houtman, 1968; Davis & Roweton, 1968; Train, 1967; Warren & Davis,

1969) have developed "long" and "short" idea checklists derived from Osborn's (1963) "73 idea-spurring questions."

The "short" checklist intended to stimulate ideas for changing a product (Davis, Roweton, Train, Warren, & Houtman, 1969), included just seven items: (1) add and/or subtract something; (2) change color; (3) vary materials; (4) rearrange parts; (5) vary shape; (6) change size; (7) modify design or style. Typically, Ss are instructed to list as many physical changes as possible for a common object. Compared with the performance of control subjects, college students using this checklist produced significantly larger numbers of creative ideas for changing or improving a thumbtack and a kitchen sink (Davis & Roweton, 1968).

Roweton (1969) recently reported that the short checklist is even more effective if Ss are required to list adjectives for 5 minutes prior to creative problem solving, but, only if the checklist remained available to Ss throughout the experiment. Hence, mental "set" (i.e., adjective production) may be an important adjunct to the checklist procedure.

Warren and Davis (1969) compared the idea-generating effectiveness of the short checklist described above, Osborn's "73 idea-spurring questions," the morphological synthesis procedure, and a no-training control condition. Results indicated that Ss in the Short Checklist and the Morphological Synthesis Groups produced the greatest total number of ideas and the greatest number of high-quality ideas.

One might argue that this technique could make students dependent on checklists, thus preventing them from "thinking for themselves." However, idea checklists mainly serve to stimulate original thinking. Thus, they are intended to supplement, not to replace, more intuitive forms of creative behavior (Davis, 1969).

Creative Analysis

Upton and Samson's (1963) workbook-program, Creative Analysis, is appropriate for both high school and college students. The workbook provides practice in naming qualities, noting relationships (similar or different), abstracting, and using similies, metaphors, and analogies. It obviously focuses upon strengthening many verbal abilities. Although Upton and Samson claim the workbook can substantially raise IQ's, little experimental documentation of these assertions is available.

Instructions and Pre-problem Activities

Davis and Manske (1966) suggested that original (and creative) ideas are typically combinations of previously unrelated ideas. Using the Unusual Uses Test, their method of stimulating new combinations of ideas was to instruct Ss to imagine themselves in particular situations and then to find uses for particular objects within those situations. For example, Ss might be instructed to "imagine you are on a picnic at the beach. List as many uses as you can for a hanger within that situation." Compared with control Ss who did not receive the "situation" instructions, the instructed Ss produced a significantly larger total number of ideas, a larger number of ideas rated as original, a higher proportion of original ideas (original/total), a larger number of "good" ideas (rated as both original and practical), and a higher proportion of "good" ideas ("good"/total).

Some investigators have shown how S's problem-solving attitude relates directly to creative idea production. Maier and others (Maier & Hoffman, 1960, 1961, 1965; Maier & Solem, 1962) have studied group problem-solving environments. If a group leader considered his subordinates as "idea men," innovative solutions were more probable, and Ss were found to be more satisfied with their solutions (Anderson & Fielder, 1964; Maier & Hoffman, 1961). Also, in small problem-solving groups of four college Ss each, solutions were judged more creative on the second presentation of the same problem (Maier & Hoffman, 1960) or if the task were perceived by the problem solvers as a problem as opposed to a decision (Maier & Solem, 1962).

Other pre-problem activities effect idea production and the likelihood of original responses. Maddi, Charlens, Maddi, and Smith (1962) presented Ss with a single stimulus continuously, free activity, or a novel stimulus. On a subsequently administered adjective checklist, Ss who were exposed to the same continuous stimulation expressed the greatest desire for novelty and yet produced the least imaginative stories on a projective test.

Using Guilford's Plot Titles task, in which Ss attempt to generate clever titles for simple story plots, Johnson and Zerbolio (1964) found that practice producing clever titles would lead to more accurate judgments of the cleverness of other titles, while practice judging did not facilitate title production.

CREATIVITY IN CLASSROOMS

Programs and Procedures

Most educators believe that creative behavior should be taught and/or encouraged in school. Some feel that creativity can best be encouraged by very "clever" teachers within subject-matter contexts (e.g., Williams, 1967). Torrance (1959, 1965, 1968a) suggested that classroom atmosphere and teacher attitudes can help children become sensitive to and tolerant of new and unusual ideas. However, the deliberate facilitation of creative behavior has been largely ignored by education.

Creative thinking courses and programs expressly designed for classrooms are primarily directed at teaching young students attitudes and abilities conducive to creative behavior. Parnes and his associates produced a number of experimental and theoretical papers related to his course in creative thinking taught at the University of Buffalo (Meadow & Parnes, 1959; Meadow, Parnes, & Reese, 1959; Parnes, 1961, 1962, 1963a, 1963b, 1967a, 1967b; Parnes & Meadow, 1959, 1960). The most significant conclusions were that creative imagination can be deliberately developed, with accompanying increases in such personality traits as confidence, initiative, and leadership potential (Parnes, 1962). The course focuses on the "organized" or "forced" procedures used successfully in industry to systematically generate ideas. The 1953 and 1957 editions of Osborn's (1963) Applied Imagination were used as texts, although in the earliest years of the course Osborn's (1948) Your Creative Power was used (Parnes, 1962). The most strongly emphasized concept in Osborn's books, hence in Parnes' course, is the principle of deferred judgment, sometimes referred to as the "forced separation of the creative and judicial functions." In addition to Osborn's brainstorming procedure, Ss were taught the checklist and attribute-listing procedures and procedures for systematically evaluating solutions. Students are also briefed on such critical issues as cultural, perceptual, and emotional blocks to creative imagination, keeping "idea records," finding and defining problems; most importantly, the students are taught that every individual can increase his creative potential with training and practice.

More recently, Parnes (1968) developed a high school creative thinking program, available only on microfilm, based upon his college level workbook (Parnes, 1967a, b).

Covington, Crutchfield, and Davies' (1966) self-administered Productive Thinking Program trains creative thinking skills in Fifth and Sixth Grade Ss. General Problem Solving, Series One of the program, consists of a sequence of detective stories. Along with the chief cartoon characters ("Jim," "Lila," and "Mr. Search," a part-time detective), Fifth and Sixth Grade students attempt to solve each mystery. The development of favorable attitudes toward "thinking," one of the program's primary objectives, occurs by building up Ss' self-confidence in dealing with complex thinking tasks and demonstrating the value of such principles as "don't be afraid of being wrong," "don't give up too easily," "everyone can learn to use his mind." The program teaches the student to define in his own words the problem he is working on, to be "planful" in attacking the problem (e.g., systematically listing the main ideas, then exploring the particular ideas which follow from the main ones), to check ideas against the pertinent facts, to search for many and unusual ideas, and to look at the problem for a different point of view if he gets stuck. Opportunity for repeated practice of these thinking guides is built in, since they are used repeatedly in solving the mysteries. The Productive Thinking Program, instead of requiring the student to make a "correct" response, provides feedback to the student in the form of a range of valuable ideas, worthwhile questions, or fruitful strategies which he might have suggested at that point in the mystery. The student also receives vicarious reinforcement through seeing Jim and Lila successfully solve mysteries by using the "thinking guides."

The Myers and Torrance (1964, 1965a, 1965b, 1966a, 1966b) five Idea Books encourage attitudes favorable to creativity by reinforcing imaginative responses to nonsense questions such as "Does the sun sound tired today?" The abilities of students in the "intermediate" grades are strengthened by exercises in remembering, free-associating, discerning problems, perceiving relationships, imagining and elaborating on wild ideas, predicting or making up consequences of unusual events, filling in information gaps, pretending, and being aware of sights and sounds. They also are trained to use descriptive adjectives to find unusual uses for common objects, to make up story plots, puzzles, punch lines, mysteries, and even more exercises.

Over a number of years Torrance has developed creativity tests designed for use with his

Idea Books but which have become the most (or only) standard test battery in creativity research. Seven verbal (e.g., product improvement, unusual uses, guess causes) and three nonverbal (figural) tests are available (Torrance, 1968b), each with explicit scoring instructions. Incidentally, the originality and frequency scores are unfortunately confounded in Torrance's tests, since S's originality score is obtained by adding the originality scores of the ideas without dividing by the number of ideas produced. Although not perfect, the Torrance tests are the most commonly used set of measures available.

Davis and Houtman's (1968) creative thinking program for Seventh and Eighth Grade students, Thinking Creatively: A Guide to Training Imagination, has combined the positive aspects of previous programs by including many different learnable idea-generating procedures. Through humorous story dialogue, cartoon characterizations, and exercises, Thinking Creatively, individually or group administered, teaches attitudes, abilities, and techniques appropriate for creative behavior (Davis, 1969). For example, through the actions of the story's four characters—Mr. I (a backyard scientist), Max (a talking bear), and Dudley and Maybelle (young children and friends of Mr. I)—students learn the attitude of "constructive discontent," the notion that virtually anything can be improved. Also, students learn to readily accept wild and unusual ideas as part of the creative process. Concerning abilities, Mr. I continually reminds students of their inherent potentiality to become better "idea-finders" with appropriate practice and procedure. Students are taught four main idea-finding techniques—attribute listing, morphological-synthesis, checklist, and synectics methods. Exercises are provided for the practice of each technique.

Davis, Houtman, Warren, and Roweton (1969) reported that, in a preliminary field test, responses to an attitude questionnaire and three divergent production tasks (such as thinking of changes and improvements for a door knob) showed Thinking Creatively to be effective. Twenty-three Ss (21 Seventh- and 2 Eighth-Grade students) who studied the program in a 10-week creative thinking course produced 65% more ideas on the divergent thinking tasks (ideas which were rated as significantly "more creative") than 32 Seventh-Grade control Ss enrolled in a creative writing course. There also was good indication that the trained Ss acquired attitudes more favoring creativity, including confidence in their own creative ability, than the control Ss.

Additional Procedures

Cartledge and Krauser (1963) selected 120 Ss from 187 First Graders who obtained low scores on several (Torrance) non-verbal creativity tests. Experimental Ss, but not control Ss, received in five 20-minute sessions instructions in Osborn's brainstorming principles and practice in generating ideas to improve a toy. Both the experimental and the control groups were given either a quantitative (all responses reinforced) or qualitative (only original responses reinforced) motivational treatment. The non-verbal creativity tests were readministered and the results indicated that experimental Ss increased their creativity scores significantly more than did the Control Ss. Type of motivation had no effect. Unfortunately, Cartledge, et al., did not follow up the original experiment to assess the more important long-term effects of originality training in First Grade.

Scott and Sigel (1965) tested the effects of "inquiry" training in Fourth, Fifth, and Sixth Grade physical science classes. Inquiry training permits students more freedom and individualized activities which are considered conducive to idea production. Measures of science concepts learned, divergent thinking, and cognitive styles were obtained. Results indicated that Fifth Grade students receiving inquiry training learned science concepts better than Fifth Graders under conventional teaching. Also, students presented inquiry training were more flexible behaviorally and more attentive to details.

Anderson and Anderson (1963) gave Sixth Grade boys "originality training" in the form of 10 30-minute sessions in which the boys listed uses for familiar stimulus objects. When tested on different objects, trained Ss gave more novel responses than control Ss. There were no differences between the two groups, however, in solving three insight problems.

As a final note on training creativity in education, just one interesting voice questions the value of encouraging divergent thinking in children at all. Wallen (1964) suggests that, conceivably, training in non-evaluative divergent thinking may encourage sloppy, illogical, and incoherent thinking. Furthermore, he notes, there is no clear evidence that such training will increase the number of outstanding creative individuals.

III

CURRENT STATUS OF THEORY IN CREATIVITY

Neither the definitional, behavioristic, psychoanalytic, dispositional, nor the operational approaches, singularly or in combination, adequately deal with creativity. No existing approach, for instance, simultaneously investigates both relatively simple laboratory (e.g., unusual uses, product-improvement problems) and complex natural (e.g., artistic, poetic) creative expression. Furthermore, studies have inadequately attended to the validity and reliability of their creativity measures and to certain apparently crucial covariates, e.g., intelligence. In addition, many independent variables, relatively easy to manipulate, have not been investigated. Some examples might be transfer phenomena, biological correlates, arousal level, and so forth. Also, particularly concerning creative thinking books, programs, and techniques, little consideration has been given to some obvious questions regarding longitudinal effects of training procedures, developmental trends (aged vs. young) of creative expression, comparative (human vs. sub-human problem-solving behavior) studies, techniques designed for specific subject-matter areas (a certain technique may be more facilitative in one subject-matter area than another), etc. Regardless of the status of present approaches, however, certain promising trends suggest an "ideal" approach.

This ideal approach to the study of creativity most basically requires objective (valid and reliable) response data. Essentially, a theory, hypothesis, or definition of creativity, is scientifically acceptable only if the behavior to which the approach refers is publically repeatable, testable, and potentially falsifiable (see Baldwin, 1967). Any effort to restrict the generation of such hypotheses will serve to limit the scope of scientific investigations. Furthermore, the ideal approach must fully appreciate the complex intricacies of the creative process without regarding it as mystical or spiritual behavior; creativity must be researchable. However, the goal of the ideal approach would not be merely the identification and measurement of complex personality dimensions and cognitive processes underlying creative behavior. Attention also must be given to learnable procedures which enhance creative expression in both simple laboratory and complex educational and industrial situations.

By studying personality, the creative process is considerably clarified. Furthermore, by systematically manipulating learning variables and creative idea-facilitative operations, the rigor of experimental psychological methodology may also be invoked. A promising new research trend will combine the study of personality processes, the rigor of experimental psychology, and the learnable procedures and programs systematically effecting creative expression.

In sum, creativity, in and out of the scientific community, has unlimited potential for growth as an area of researchable human behavior. Potential applications of creative thinking programs, books, and learnable techniques cannot exhaust even the wildest imagination. Surprisingly enough, the extent of research (but not theory) to date is immense but not complete, particularly in regard to the previously mentioned difficulties. Again, no fully matured and comprehensive theoretical statement is available. The present state of the art is a mixture of some models, limited applications, operational and non-operational definitions, random speculation, and some hypothesis-testing. Nonetheless, creativity is coming of age.

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